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<p>(54) Title: <b>CIRCULAR SLITTING KNIFE</b></p> <p>(57) Abstract</p> <p>A circular slitting knife, particularly a circular slitting knife, which is designed to slit relatively soft plain or composite materials, such as textile, paper or plastic materials or the like materials. Said circular slitting knife is designed to work against a holding-on cylinder (15), possibly made of a plastic, rubber or comparable material. Said circular slitting knife has a thin circular slitting blade (1). On either side of said slitting blade rings (2, 3) or discs made of a rubber or a plastic material are mounted. Said rings or discs are pressed against said slitting blade by means of clamping devices, such as outer metal plates (4, 5) or the like.</p> <div data-bbox="1015 1144 1291 1806"> </div>		

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## CIRCULAR SLITTING KNIFE

## TECHNICAL FIELD

- 5 The present invention relates to a circular slitting knife, particularly a circular slitting knife, which is designed to slit relatively soft plain or composite materials, e.g. textile, paper, plastic materials or a combination of such materials. Said circular slitting knife  
10 is designed to work against a counter pressure cylinder, e.g. made of a plastic, a rubber or a comparable material.

## THE STATE OF THE ART

- Swedish printed publication 394 091 relates to a slitting  
15 device having a circular rotating slitting knife. In this device two circular discs made of an elastic material are disposed on either side of the rotary slitting knife. The diameter of the discs of an elastic material is somewhat smaller than the diameter of the rotary slitting knife.  
20 Since the slitting is done in grooves and said circular discs of an elastic material run along the edges of the groove, the slitting edge is caused to run with a higher circumferential speed than if the edge would run against a firm support and provided the translational speed of  
25 the shaft of the slitting knife would be the same. This slitting device is at a disadvantage partly because it has to run in a groove and partly because it must be made comparatively thick, if hard materials, e.g. hard metals, are to be used.  
30 German printed publication 3 446 161 relates to a slitting device having a circular slitting knife, which to a certain degree is laterally supported by means of, in relation to the slitting knife, partly elastically mounted and partly  
35 rigidly mounted elements. Said lateral supporting elements are designed partly to avoid a waved deformation of the

slitting knife and partly to brake the knife to some extent. This device is hardly suitable when thin discs made of e.g. a hard metal are to be used, since the lateral support is unsymmetrically distributed in relation to the  
5 central shaft of the slitting knife.

Furthermore, USP 3 358 370, 4 086 835 and 3 293 962 relate to slitting devices having disc-shaped slitting knives or having knives designed as ring-shaped slitting  
10 knives on slitting cylinders. These specifications relate to slitting devices, which are at a disadvantage either because the slitting knife must perform in a groove or is provided with slitting teeth. When the slitting is done in grooves, the grooves must be designed differently  
15 for different materials to be slit and when the slitting is done by toothed slitting knives, the toothing ought to be matched with the material to be slit.

Generally when slitting textile materials by means of  
20 slitting devices according to the above-mentioned specifications as well as generally when known slitting devices are used, as a rule a lot of fluff is obtained and consequently uneven edges having a faulty finish.

#### 25 A DESCRIPTION OF THE INVENTION

The object of the present invention is to provide an improved circular slitting knife of the kind described above. The improvement which we try to attain in the first place is to eliminate the disadvantages of known constructions.  
30 The desired result is attained by designing the circular slitting knife in such a way, that it will include a thin circular slitting blade having an edge and on either side of this slitting edge rings or discs made of a rubber or a plastic material. Said rings or discs are pressed against  
35 the slitting blade by means of clamping tools, such as outer metal plates or the like.

One of the characterizing features of the circular slitting knife according to the invention is the combination of the thin blade having an edge, the rings or plates made of a rubber or a plastic material as well as clamping tools such as outer metal plates or the like. Another characterizing feature is that said rubber rings or plates do not have to be fastened to the slitting blade by curing.

Generally said circular slitting knife can be used to slit various composite soft materials, such as textile materials, paper materials, plastic materials etc. as well as various composite materials.

Additional characterizing features of the present invention and advantages of it will be set forth in the following description as well as in the following patent claims.

#### A BRIEF DESCRIPTION OF THE DRAWINGS

In the following description reference is made to the accompanying drawings, in which:

Fig. 1 is a central longitudinal section along the rotational shaft of the circular slitting knife;

Fig. 1 B shows, scaled up, the deformation of the elastic plates, when a slitting is done according to a preferred embodiment;

Fig. 1 A shows the same detail as in Fig. 1 B, when the circular slitting knife is removed from the holding-on cylinder and consequently is not slitting;

Fig. 2 shows details corresponding to the details shown in Fig. 1 A and 1 B, according to an additional preferred embodiment;

Fig. 3 is a perspective exploded view of the circular slitting knife and devices which support the circular slitting knife; and

Fig. 4 shows a plurality of circular slitting knives, which

are mounted to simultaneously slit a passing web material into a plurality of narrow strips (tapes).

#### A DESCRIPTION OF PREFERRED EMBODIMENTS

- 5 The circular slitting knife comprises a circular blade 1 made of a hard metal or possibly of a metal having a hard metal edge and on either side of said blade a ring, 2 respectively 3, made of a rubber or a plastic material, e.g. polyurethane. Rubber rings 2,3 are clamped by outer metal  
10 plates 4,5.

According to a first preferred embodiment, which is shown in Fig. 1 B; rings 2,3 taper towards the edge. The tips of rings 2,3 cover the edge of slitting blade 1 and conse-  
15 quently said edge can not be damaged or the operator cannot be hurt by the edge. During slitting rings 2,3 are pressed inwardly and somewhat outwardly and consequently the edge is set free as is shown in Fig. 1 B.

- 20 Also, since the rubber or plastic material which rings 2,3 are made of is pressed outwardly, the slit edge surfaces tend to separate. The embodiment shown in Fig. 1 is used e.g. to slit textile materials 14, such as fabrics and cloths.

25 Fig. 3 is an exploded view of the circular slitting knife according to Fig. 1. Outer metal plate 4 is provided with a tubular shaft having an inner thread. A screw 6 has a thread, which corresponds to said inner thread. By means  
30 of screw 6 outer metal plates 4,5, slitting blade 1, rings 2,3 as well as two ball bearings 7A,7B belonging to said inner rings can be secured to each other, a unit bound together being obtained thereby. Outer metal plate 4 is provided with two holes 19A,19B, which allow plate 4 to  
35 be fastened, when screw 6 is tightened. The ball bearings are mounted in a press arm 8, which by means of an eccent-

ric 10, a counter spring, not shown in the figure, as well as arm 11 can be rotated in any direction about a shaft 20 and be fastened in two positions. Consequently, by switching arm 11 the circular slitting knife can be pressed against a nylon cylinder 15 or be removed from cylinder 15.

Blade 1 has a thickness of just 0.3 mm and a diameter of 45 mm. The slitting is done against a holding-on cylinder made of nylon in the embodiment shown in Fig. 1. The edge penetrates into the nylon cylinder just a few tenths of a millimeter.

Fig. 2 shows a modified embodiment, designed to slit a paper 14'. In this case rather thick paper materials or several layers can be slit. As many as 15 sheets having a surface weight of 70 g/cm<sup>2</sup> have been slit successfully. In this case those portions of rubber rings 2,3, which taper towards the edge, have been removed.

Rings 2,3 in Fig. 1 may also be turned round, the sharp edges thereby being placed outwardly instead of contacting blade 1. In this embodiment the rubber rings assist in the rotation of the knife.

In all the embodiments rubber rings or plastic rings 2,3 assist in protecting thin blade 1 against breaking. In case rings 2,3 of a plastic or a rubber material are excluded or are replaced by metal rings, thin blade 1 is broken after it has been used for a short period of time. The breaking probably is caused by strong vibrations, which are reduced by means of rings 2,3 or 2',3' in Fig. 2. To solely use metal plates does not solve the breaking problem, when e.g. thin hard metal discs are used.

When paper materials are slit according to Fig. 2, hol-

ding-on cylinder 15 is made of a hard polyurethane.

In the embodiment shown in the exploded view, Fig. 3, press arm 8 is mounted on an arm holder 9, which in its turn is slidably mounted on a guide 16. Guide 16 is provided with a wedge control, which ensures, that arm holder 9 does not rotate about guide 16. Arm holder 9 can by means of a lock arm 13 be locked in any desired position on guide 16.

10

Fig. 4 shows how a plurality of circular slitting knives according to the invention can be used to slit a band-like web material into five parts. Web material 14 is pulled in the direction indicated by the arrow, while it is contacting holding-on cylinder 15.

15

A few embodiments and modifications thereof have been described above. Other modifications of the described embodiments than the ones stated above are possible without deviating from the general principles of the present invention and without said modifications resulting in the modified device ending up beyond the scope of the patent claims as set forth on the following pages.

25

30



## PATENT CLAIMS

1. A circular slitting knife, designed to work against a holding-on cylinder (15) made of a plastic, a rubber or a composite material, in order to slit relatively soft materials, such as textile, paper, plastic or similar materials or combinations of such materials (14), c h a r a c -  
t e r i z e d in that said circular slitting knife comprises a thin circular slitting blade (1) having an edge  
and on either side of this slitting blade rings or discs made of a rubber or a plastic material (2,3), which are pressed against said slitting blade by means of clamping devices, such as outer metal plates (4,5) or the like, that said rings or discs of a rubber or a plastic material roughly have the same outer diameter as the slitting blade, which means that they roughly cover the edge, and that said rings or discs at least not in their peripheral parts adhere to said slitting blade but rather are designed in such a way that they, when a slitting is done, can be forced out of the area of the edge and set it free.
2. A circular slitting knife according to claim 1, c h a r a c t e r i z e d in that said rings (2,3) have two plain surfaces, which are perpendicular to the rotational symmetry axis of said rings, as well as at least one cylindrical surface.
3. A circular slitting knife according to claim 2, c h a r a c t e r i z e d in that said two plain surfaces, which are perpendicular to said rotational symmetry axis of said rings (2,3), have different sizes.
4. A circular slitting knife according to claim 3, c h a r a c t e r i z e d in that said rings (2,3) have a conical envelope surface.

5. A circular slitting knife according to claim 4,  
c h a r a c t e r i z e d in that the largest diameter  
of said rings (2,3) corresponds to the diameter of said  
slitting knife (1) or is up to 0.1 mm larger than the  
5 same.

6. A circular slitting knife according to claim 5,  
c h a r a c t e r i z e d in that said elastic rings  
(2,3) are mounted on either side of said slitting blade  
10 (1) in such a way, that their largest plain surfaces are  
pressed against said slitting blade (1).

7. A circular slitting knife according to claim 6,  
c h a r a c t e r i z e d in that said elastic rings  
15 (2,3) are mounted on either side of said slitting blade  
(1) in such a way, that their smallest plain surfaces  
are pressed against said slitting blade (1).

8. A circular slitting knife according to any of the pre-  
20 ceding claims, c h a r a c t e r i z e d in that the  
clamp force, which is exerted by means of the clamping  
devices (4,5), is generated by at least one screw faste-  
ning (6,4), the axis of which coincides with the rotation-  
al axis of said circular slitting knife.

25 9. A circular slitting knife according to any of the pre-  
ceding claims, c h a r a c t e r i z e d in that said  
slitting blade or at least its edge is made of a hard  
metal.

30 10. A circular slitting knife according to any of the pre-  
ceding claims, c h a r a c t e r i z e d in that said  
slitting blade (1) has a thickness, which is not larger  
than 1 % of the diameter of the blade and preferably is  
35 within the interval 4-8 <sup>0</sup>/oo of the diameter of the blade.

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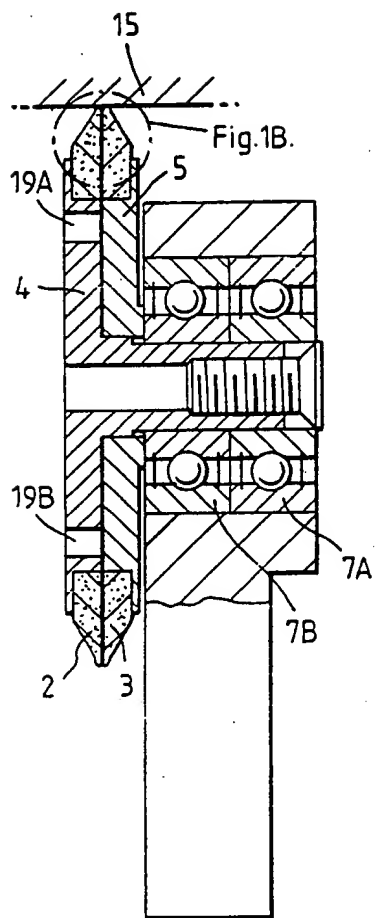


Fig.1.

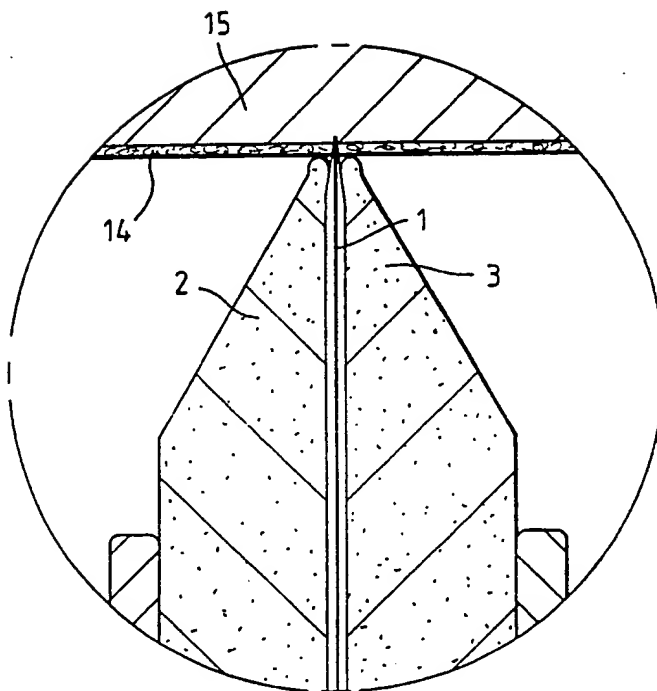
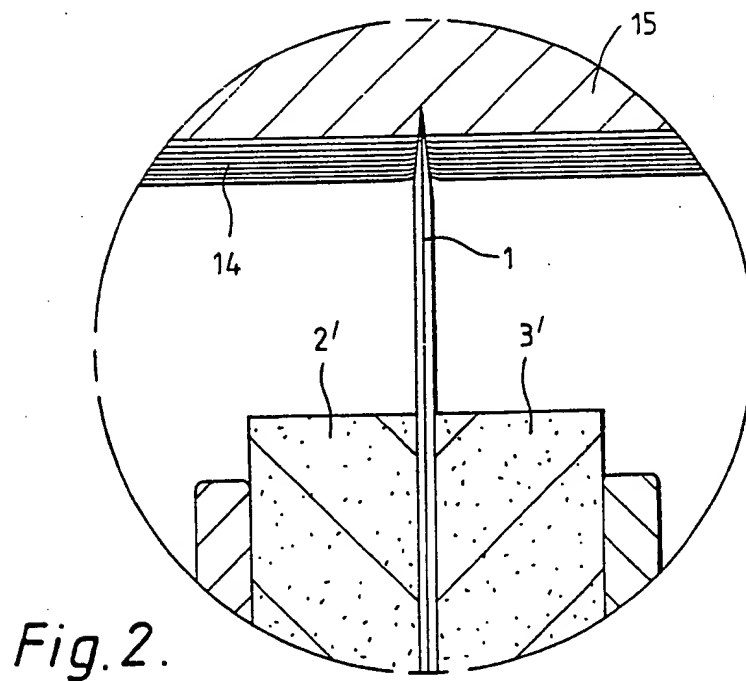
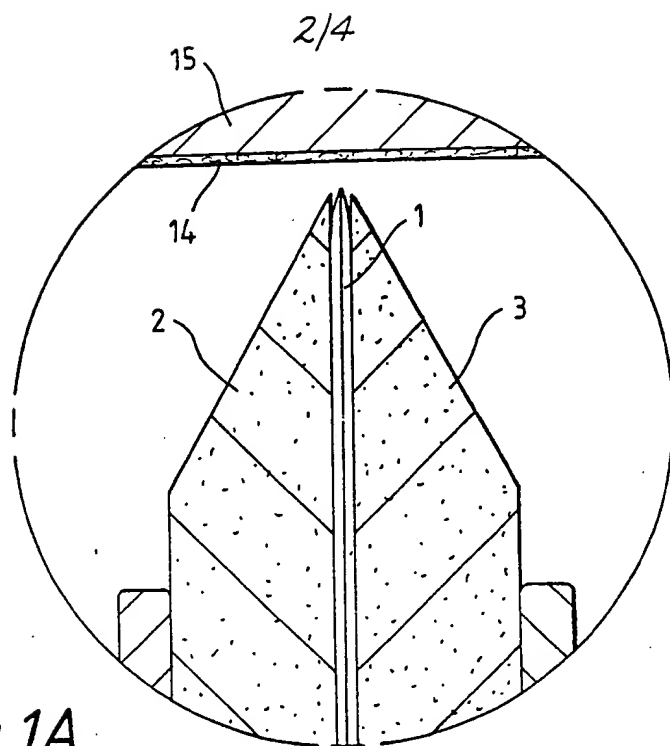


Fig.1B.



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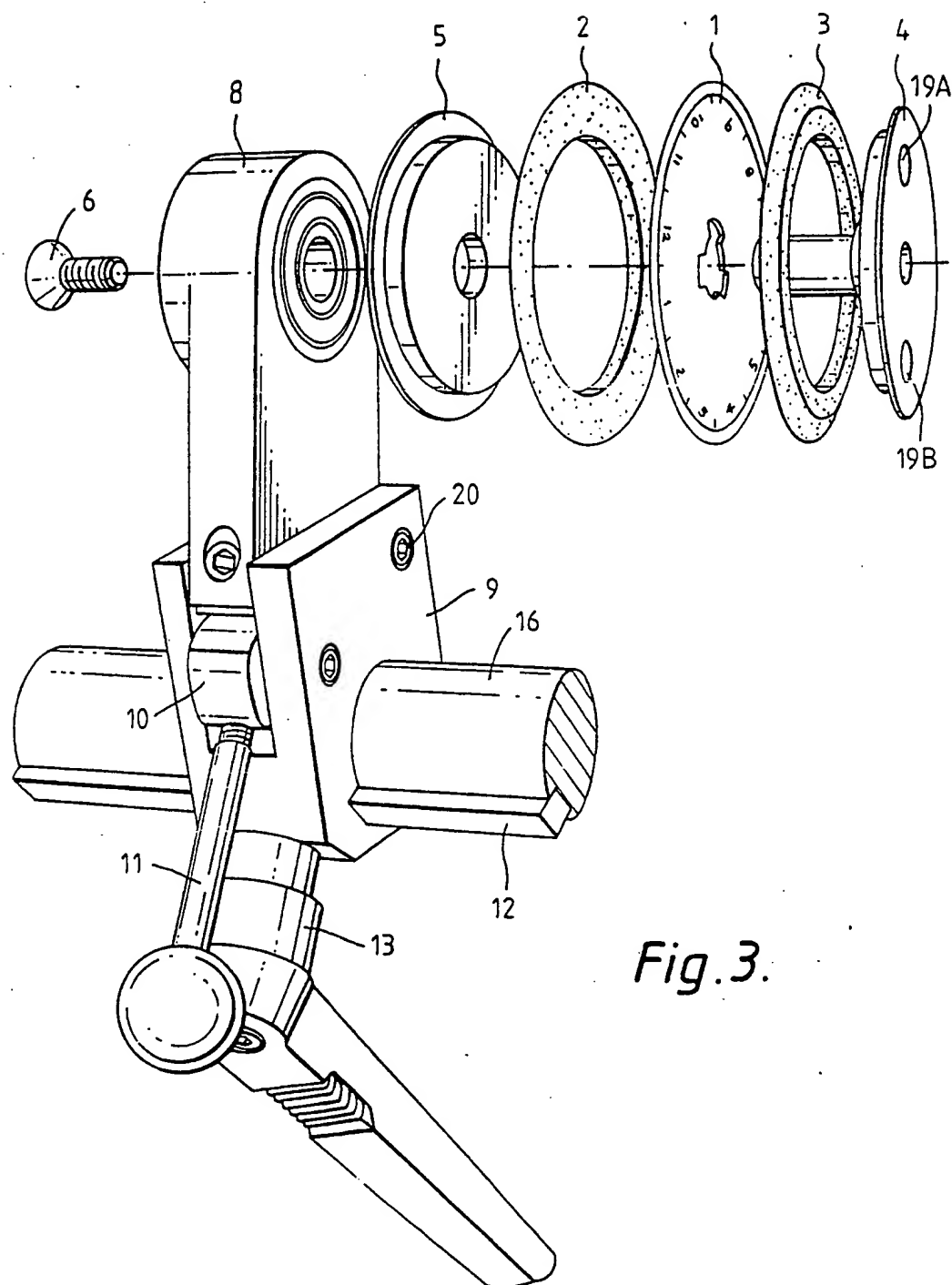


Fig. 3.

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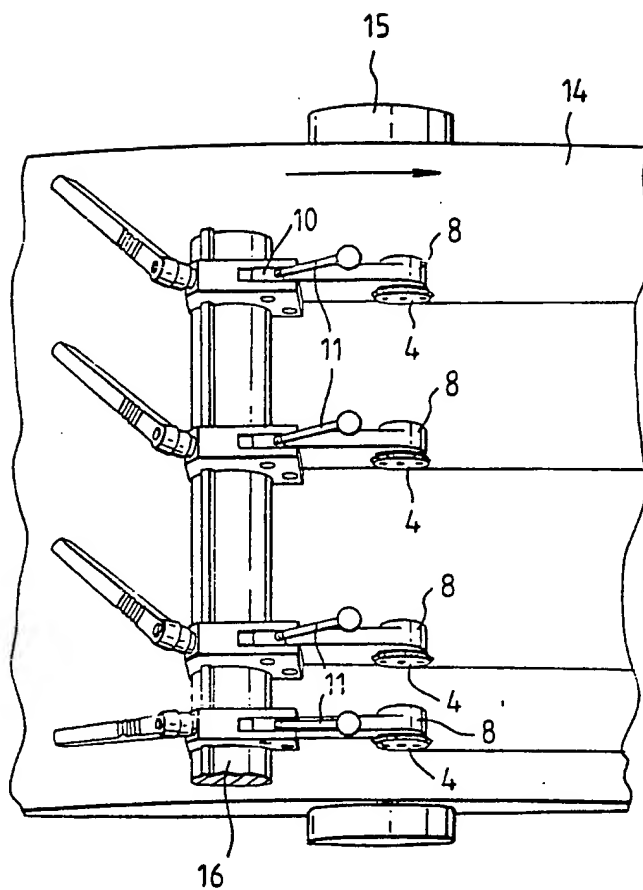
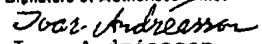


Fig. 4.

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE88/00594

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC 4 <div style="text-align: center; padding: 5px;">B 26 D 1/14</div>		
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; padding: 5px;">Minimum Documentation Searched 7</div>		
Classification System IPC 4 US C1	Classification Symbol: B 26 D 1/12-1/43; B 25 B 25/00; B 26 D 7/26 30:306, 307, 347; 83:56, 98, 331, 332, 348, 469, 471, 483, 484, 501-505	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched * <div style="text-align: center; padding: 10px;">SE, NO, DK, FI classes as above</div>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT 8</b>		
Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
A	DE, A1, 3 446 161 (KAI CUTLERY CENTER CO, LTD, SEKI, GIFU ) 2 January 1986	1-10
A	SE, B, 394 091 (EKDAHLVERKEN AB) 6 June 1977	1-10
A	US, A, 3 293 962 (P. GIANARIS) 27 December 1966	1-10
A	US, A, 3 358 370 (R.W. LOGAN) 19 December 1967	1-10
A	US, A, 2 862 231 (W. VOIGT) 2 December 1958	1-10
A	US, A, 1 968 242 (G.B. BIRCH) 31 July 1934	1-10
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